

CLAIMS

What Is Claimed Is:

- 1 1. A heterodyne interferometer system with carrier phase modulation comprising:
- 2 a laser light source;
- 3 a phase modulator positioned to receive a beam from the laser light
- 4 source and apply a sinusoidal carrier phase modulation;
- 5 a frequency shifter for shifting the frequency of a target beam and a local
- 6 beam emanating from the phase modulator, the difference
- 7 between the target beam frequency and the local beam frequency
- 8 designated as the heterodyne frequency  $f$ ;
- 9 a reference photodetector;
- 10 a signal photodetector;
- 11 a beam splitter for deflecting a portion of the target beam and local beam
- 12 to the reference photodetector and directing another portion of the
- 13 target beam and local beam to a polarizing beam splitter;
- 14 a polarizing beam splitter for directing the local beam directly to the
- 15 signal photodetector, and for directing the target beam to a pair of
- 16 reflectors separated in distance by  $L$ ;
- 17 a signal mixer for mixing the phase-modulation frequency with the
- 18 output of the signal photodetector to shift the target signal to the
- 19 heterodyne frequency  $f$  and shifting a self-interference signal into
- 20 sidebands about the modulation frequency;

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21 a bandpass filter at the heterodyne frequency  $f$  to isolate the target signal  
22 and exclude the self-interference signal; and  
23 a phase meter to receive signals from the reference photodetector and  
24 compare the phase with a phase of the target signal filtered by the  
25 bandpass filter.

1 2. The heterodyne interferometer system of claim 1 wherein the phase modulation  
2 frequency is selected to optimize the target signal having traveled the distance  $L$ .

1 3. The heterodyne interferometer system of claim 1 wherein the target beam and  
2 the local beam are polarized in orthogonal planes.

1 4. The heterodyne interferometer system of claim 1 wherein the target beam is  
2 synchronously demodulated at the phase modulation frequency.

1 5. The heterodyne interferometer system of claim 1 wherein the self-interference  
2 signal is suppressed by a factor of  $L/L_{INT}$ .

1 6. The heterodyne interferometer system of claim 1 further comprising a second  
2 frequency shifter.

1 7. A heterodyne interferometer comprising:  
2 a light source for providing a carrier signal;  
3 a modulator for modulating the carrier signal;

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4 a target path for directing a first portion of the modulated carrier signal to a  
5 target;  
6 a reference path for directing a second portion of the modulated carrier signal to  
7 a reference location; and  
8 a comparator for comparing the first portion of the modulated carrier signal with  
9 the second portion of the modulated carrier signal to determine a distance between the  
10 target and a fixed point.

1 8. The heterodyne interferometer of Claim 7 wherein the modulator applies a phase  
2 modulation at a modulation frequency to the carrier signal, and wherein the first portion  
3 of the modulated carrier signal is demodulated at the modulation frequency after being  
4 directed to the target.

1 9. The heterodyne interferometer of Claim 8 further comprising a frequency shifter  
2 for shifting the frequency of the carrier signal prior to the directing of the first and  
3 second portions of the carrier signal to the target and reference location, respectively.

1 10. The heterodyne interferometer of Claim 8 wherein the comparator comprises an  
2 intensity comparator to discriminate between a signal traveling from the target with a  
3 parasitic self-interference signal.

1 11. A method for distinguishing a target signal in a heterodyne interferometer with a  
2 parasitic interference signal comprising the steps of:  
3 providing a signal source to deliver a carrier signal;

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4 applying a modulation to the carrier signal, where said modulation is selected  
5 from one of phase modulation and frequency modulation;

6 directing a first portion of the modulated carrier signal to a path that includes a  
7 target, where the heterodyne interferometer evaluates a distance between a fixed location  
8 and the target;

9 directing a second portion of the modulated carrier signal to a reference location;

10 demodulating the first portion of the modulated carrier signal at a frequency  
11 selected based upon the modulation of the carrier signal; and

12 evaluating an interference intensity modulation to discriminate between a  
13 parasitic interference and a portion of the modulated carrier signal that has traveled to the  
14 target.

1 12. The method of claim 11 further comprising the step of shifting the frequency of  
2 the carrier signal prior to directing the first and second portions of the modulated carrier  
3 signal.

1 13. The method of claim 11 wherein the step of modulating the carrier signal  
2 comprises a phase modulation.

1 14. A method for filtering a self-interference signal in a heterodyne interferometer  
2 from a true signal based on a phase difference between the self-interference signal and  
3 the true signal comprising the steps of:

4 providing a carrier signal;

5 phase modulating the carrier signal at a modulation frequency  $\Omega$ ;

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6 directing a portion of the modulated carrier signal to a target and providing for a  
7 return of the portion of the modulated carrier signal from the target, the portion of the  
8 modulated carrier signal having traveled to and from the target being designated as a true  
9 signal;

10 providing a photodetector for receiving both the true signal and an interference  
11 signal;

12 demodulating the output of the photodetector at the modulation frequency  $\Omega$  to  
13 isolate the interference signal from the true signal; and

14 filtering the interference signal from the true signal based on the isolation of the  
15 previous step.

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